REMARKS

Claims 1-6 are pending in the above-identified application. Claims 1-6 were rejected. With this Amendment, claims 4-6 were amended, claims 7-11 were added and claims 1-3 were cancelled. Accordingly, claims 4-11 are at issue.

I. 35 U.S.C. § 103 Obviousness Rejection of Claims

Claims 1 and 3 were rejected under 35 U.S.C. § 103(a) as being purportedly unpatentable over Hayashi, U.S. Patent No. 6,090,480. Claim 2 was rejected under 35 U.S.C. § 103(a) as being purportedly unpatentable over Hayashi in view of Arai et al, U.S. Patent No. 6,671,136. Applicants have canceled claims 1-3 without prejudice and without admitting anticipation or obviousness.

Claims 4-6 were rejected under 35 U.S.C. § 103(a) as being purportedly unpatentable over Kishi et al, U.S. Patent No. 6,730,949 in view of Hayashi. Applicants respectively respectfully traverse this rejection.

With respect to independent Claim 4 as amended, Applicants claim a magnetic memory device that has the following limitations, among others:

> *a magnetoresistive effect element [having] ... a tunnel barrier layer ... formed between a pair of ferromagnetic material layers to cause a current to flow in the direction perpendicular to the layer surface; ...*
>
> *wherein one of said ferromagnetic material layers is a magnetization fixed layer and the other ferromagnetic material layer is a magnetization free layer, said magnetization free layer is made of a ferromagnetic material containing $Fe_xCo_yB_z$, x is from 5 to 45 atomic percent, y is from 35 to 85 atomic percent, and z is from 10 to 30 atomic percent, and*

wherein said magnetization free layer has a film thickness ranging from 2 nm to 8 nm.

Independent Claim 9 has similar limitations, except Claim 9 recites that the magnetization free layer is made of a ferromagnetic material containing $Fe_aCo_bNi_cB_d$ (instead of $Fe_xCo_yB_z$) where a is from 5 to 45 atomic percent, b is from 35 to 85 atomic percent, c is greater than 0 and less than 35 atomic percent, and d is from 10 to 30 atomic percent.

Applicants teach that by controlling the composition of the FeCoBe or FeCoNiB to be within the claimed ranges and the film thickness to be within 2 nm to 8 nm, the tunnel magnetoresistive effect element (TMR) has a TMR ratio that exceeds 45% and inhibits the fluctuation of the coercive force Hc from exceeding 10%. (See Application, at pg. 19 line 12 - pg. 20 line 8, pg. 31 line 23 - pg. 35 line 12, Figs. 8, 9A, 9B, 10A, and 10B).

As acknowledged by the Examiner, Kishi fails to disclose a magnetic memory device that has a magnetization free layer comprised of FeCoB or FeCoNiB or having a thickness ranging from 2 nm to 8 nm.

Hayashi discloses a magnetoresistive device (MR) with a structure manufactured to "ensure[] heat resistance at temperatures of 200° C and above while securing sufficiently high resistance change rate." (See Hayashi, Col. 3 lines 6-9). To meet this object, Hayashi discloses that the MR device has, among other layers, a non-magnetic layer (104 in Fig. 11) sandwiched between a first free magnetic layer (102) and a fixed magnetic layer (106). Hayashi discloses that the first free magnetic layer has a thickness between 1 to 10 nm and may be made of CoFeB (see Hayashi col. 7, lines 44-48, 61-65).

But, as acknowledged by the Examiner, Hayashi fails to teach that the MR device is a tunnel magnetoresistive effect element having **a tunnel barrier layer** sandwiched between a magnetization fixed layer and a magnetization free layer. Still, the Examiner argues that it would be obvious to one of ordinary skill in the art at the time of the invention was made to use the magnetization free layer of Hayashi's MR device in Kishi's magnetic memory device.

Applicants respectfully disagree. Hayashi's MR device solves a different problem (i.e., heat resistance at temperatures of 200° C) than the present invention (i.e., a TMR device with a TMR ratio exceeding 45% while having a fluctuation of coercive force below 10%). Moreover, Hayashi teaches away from Applicants' invention and combining the Hayashi MR device with Kishi. In particular, Hayashi teaches that the thickness of the first magnetic free layer is "preferably 0.1 to 5 nm," (see Hayashi, col. 7, lines 65-66) which encompasses one of the problems Applicants invention solves. Applicants teach that a magnetization free layer having a thickness below 2 nm exhibits significant fluctuations in coercive force Hc, which is detrimental in writing to the magnetic memory device using the tunnel magnetization effect element. (See, Application pg. 5 line 23 - pg. 6 line 12, pg. 36 lines 6-10, Figs. 9B & 10B). Thus, there is no motivation to combine the teachings of Hayashi and Kishi.

Furthermore, neither Hayashi nor Kishi teach a magnetization free layer that is made using the compositions of FeCoB or FeCoNiB in conjunction with a thickness from 2 nm to 8 nm as taught and claimed by the Applicants.

Accordingly, Applicants submit that neither Hayashi nor Kishi, alone or in combination, teach all the limitations of Claim 4 or Claim 9, and respectfully request that the rejection to these claims be withdrawn.

Claims 5-8 depend from Claim 4 and should be deemed allowable for at least the reasons as Claim 4. Claims 10-11 depend from Claim 9 and should be deemed allowable for at least the reasons as Claim 9.

II. Conclusion

In view of the above amendments and remarks, Applicant submits that all claims are clearly allowable over the cited prior art, and respectfully requests early and favorable notification to that effect.

Respectfully submitted,

Dated: August 9, 2004 By: _____

Thomas J. Burton
Registration No. 47,464
SONNENSCHEIN NATH & ROSENTHAL LLP
P.O. Box 061080
Wacker Drive Station, Sears Tower
Chicago, Illinois 60606-1080
(312) 876-8000